

- Executive Summary
- Company Selection for Benchmark
- Quality Assurance Framework
- Benchmark Company Observations
- **Industry Quality Assurance Cost Estimates**
- Industry Selection of Quality Assurance Methods



The cost of quality assurance is very difficult to measure. However, we can better understand it by looking at several different points of view.

— *Measuring the Cost of Quality* —

- ◆ Benchmark company observations and anecdotes
- ◆ Cost drivers of each quality assurance method
- ◆ Cost of supplier quality concept
- ◆ Total Cost of Ownership concept

The benchmark companies do not track the cost of each quality assurance method applied, nor do they attempt to quantify the dollar benefit of quality assurance.

— Benchmark Company Observations —

- ◆ How does industry account for the cost of quality assurance?
 - NOT measured on a per unit or per acquisition dollar basis
 - Seek to minimize the cost of supplier quality, not the cost of quality assurance
 - Cost of supplier quality = cost of failure + cost of quality assurance
- ◆ Which budget is the cost of quality assurance allocated to?
 - Cost may be contained within a commodity group
 - Cost may be allocated across all finished goods or services
- ◆ Measuring the cost of supplier quality
 - Companies will not share the cost information if supplier quality provides a strategic advantage over competitors
 - In some cases, the cost of supplier quality is not tracked in a measurable format

Although industry does not measure the cost of quality assurance, the benchmark companies provided several anecdotal costs of supplier failure:

— Benchmark Company Anecdotes —

- Texas Instruments estimates fabrication down time to be \$40,000 per hour.
- Toyota Motor Company charges its suppliers \$10,000 per minute of manufacturing downtime associated to poor quality material. However, Toyota has never had to enforce this rule in North America!
- Toyota does not commence full production at new facilities until it has developed all new suppliers to deliver zero defects on a just-in-time basis.
- Toyota estimates the cost of supplier selection to be \$250,000.
- Intel Corporation dedicates 6.4 full-time equivalents to silicon quality assurance, out of the total 23 full-time equivalents in the Silicon Material and Technology Group.
- In 1988, J. M. Juran estimates the implementation cost of supplier certification to be \$500,000. This estimate includes commodity selection, personnel training, development of measurement system and streamlining quality evaluation systems.

Before a quality assurance method can be implemented, the required skills and resources must be developed or acquired. The required skills and resources identified during the benchmark study are categorized into six “cost drivers.”

- Specific cost drivers of each method — Quality Assurance Framework section
 - Identified for both implementation and ongoing application
 - Cost drivers = resource requirements with the greatest impact
 - Cost drivers were identified by synthesizing industry observations of quality assurance method resource requirements and process steps
- Identifying relevant cost drivers allows better management of “hidden” costs



The cost of supplier quality is the sum of the cost of failure and the cost of quality assurance.

— *Cost of Supplier Quality = Cost of Failure + Cost of Quality Assurance* —

Cost of Failure = Cost of Internal + External Failures

—Results of Internal Failures —

- Scrap, rework
- 100% inspection of poor quality products
- Manufacturing down time
- Material Review Board process

—Results of External Failures —

- Liability claims
- Lost customer satisfaction and revenue
- Recall
- Warranty claims

Cost of Quality Assurance = Cost of Identification + Prevention Methods

— Examples of Identification Methods —

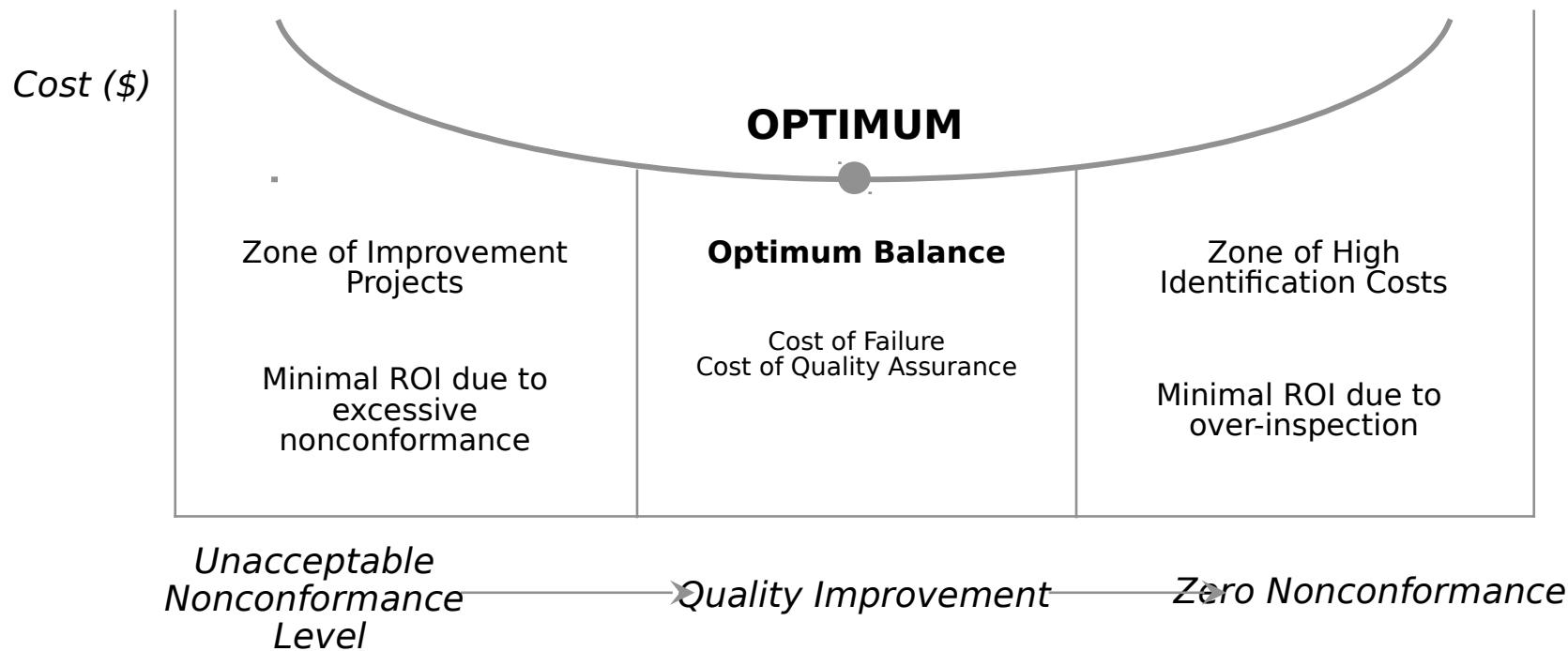
- Inspection of kind, count and condition
- Inspection of certificates of conformance
- Source inspection
- Sample inspection of good quality products

— Examples of Prevention Methods —

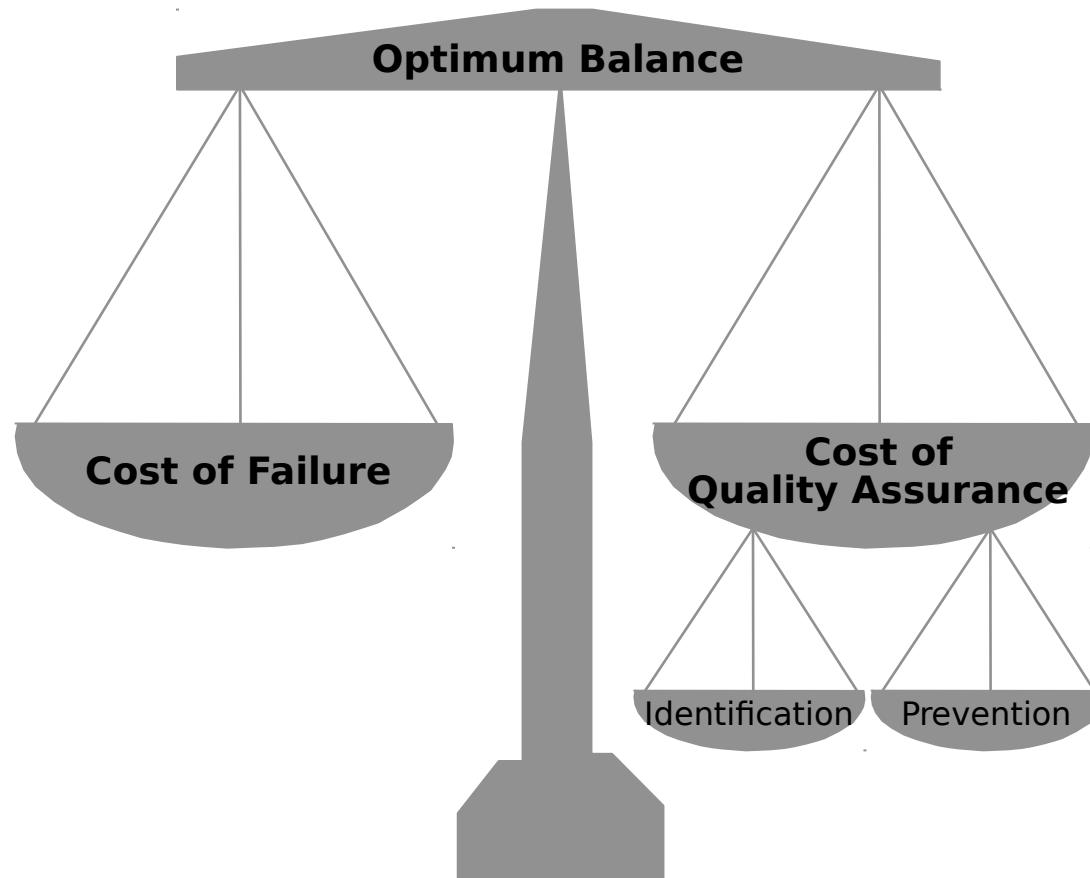
- Metrology development
- Materials qualification
- Supplier selection, qualification and certification
- Supplier feedback and recognition
- Supplier development

The cost of supplier quality curve is a theoretical tool that demonstrates how quality assurance resources can be allocated in order to increase the return on investment.

— *Cost of Supplier Quality Curve* —



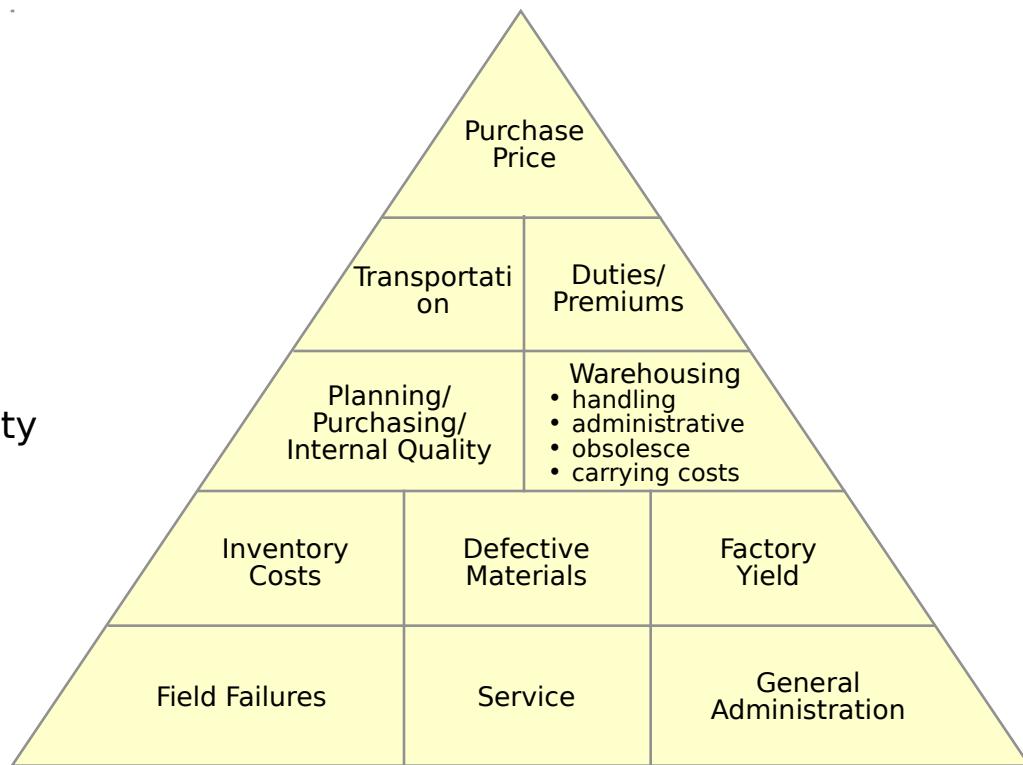
To maximize the return on investment and minimize the cost of supplier quality, two trade-offs must be balanced. First, the cost of failure must be weighed against the cost of quality assurance. Second, the cost of preventive methods must be weighed against the cost of identification methods.



Total Cost of Ownership (TCO) is a concept used to understand costs associated with a purchase, *above and beyond price*. Such costs may include supplier selection, qualification, certification, order placement, inspection, payment and quality related issues.

Easiest to identify cost and relate to unit of purchase

↑
Degree of Difficulty
↓
More difficult to identify and relate to unit of purchase



— Intel's Total Cost Pyramid —

The Center for Advanced Purchasing Studies has summarized the benefits of a Total Cost of Ownership approach for sourcing decisions.

— *Benefits Reported by Implementing Companies* —

- Provides a consistent supplier evaluation tool
- Clarifies and defines supplier performance expectations
- Prioritizes continuous improvement efforts
- Improves understanding of supplier performance issues and cost structure
- Provides excellent data for negotiations
- Potential to justify higher initial costs based on better quality
- Provides a long-term purchasing focus

Companies implement TCO selectively because the model is time consuming to develop and must be tailored to the “buy.” Applied correctly, TCO is viewed as an important tool for long-run competitiveness.

— General Characteristics of “Buys” Appropriate for TCO Analysis —

Shell	■ Bottleneck items, repetitive, high-risk
Firm Z	■ High-level decision, cost take-out opportunity: on processes
GSTG	■ Repetitive, long-term buys
Firm X	■ Up to team; big-dollar items, cost-benefit consideration
NT	■ All production inputs — up to teams if they actually want to use
Firm Y	■ Major issues with a process focus, may consider many costs simultaneously
Motorola SPS	■ Major purchases — all sector-level decisions; beyond that, it is at the discretion of the commodity team
Intel	■ \$100,000 and above, ongoing
Firm W	■ Commodity purchases, significant expenditures
TI	■ Routine, repetitive purchases with a history
SEMATECH	■ Major productive capital expenditures; can also vary other input costs/yield like raw materials, supplies — see impact of differential performance over equipment life